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TO Dr. H. F. Henry
LOCATION K-1001

DATE December 18, 1953

ANSWERING LETTER DATE

ATTENTION
COPY TO Mr. M. F. Schwenn
Mr. J. A. Parsons
Mr. H. G. P. Snyder
CCR
File

H-60965

SUBJECT Request for Special Hazards Consideration - K-311-1 Purge Facility

KP-553

KP 553 2 A

Purpose

Special Hazards consideration is hereby requested for the proposed K-311-1 purge facility.

As a result of the K-33 expansion program, it has become necessary to make provisions for the removal from the cascade of the additional upflow of "lights" introduced by the additional 640 stages of K-33. The most desirable method for removing these "lights" has been chosen, and will entail the alteration of unit K-311-1 for use as a lower purge facility. The capability of the K-311-1 purge facility will be such as to insure reduction of "lights" concentration above the purge facility to existing levels or below for adequate cascade inleakage control; the design normal K-311-1 purge capacity of 10,000 scfd should suffice to actually reduce the "lights" concentration above K-311-1 to about 50% of existing levels. Calculation* indicates that purge rates as high as 50,000 scfd can be handled with a bottoms concentration equal to existing cascade levels, and rates of 100,000 scfd can be purged under emergency conditions.

Equipment

Equipment modifications will be as follows:(1)

1. Addition of piping and tie-ins to permit operation of K-311-1 as a lower side purge above K-402-9, above K-301-5 or above K-310-1. A new housing for the new K-310-1 feed and return lines will be installed, heated by existing steam radiators in the K-309-3 to K-311-1 'B' booster housing. Adequate temperature indication will be installed.

* S. J. Zangri, unpublished calculations.

(1) "Lower Purge Facility, K-311-1, Project 1586", 8-19-53, letter from C. W. Calvin to F. B. Eastman.

2. Modification of the existing intersectional cell pumps as K-311-1 feed boosters.

3. Installation of an 8" feed header to permit changing feed points in the unit.

4. Motor, pump base and electrical changes to permit operation of cells 5, 7, 9, and 10 at required power levels.

5. Motor, pump and pump base, barrier and electrical changes, plus addition of speed increasers to operate cells 8, 6, and 4 as high speed (9,000 rpm) "lights" enrichers. Cells 2 and 3 to be permanently shut down. Size 2 aftercoolers will be utilized as interstage coolers on all stages of each high speed cell. Coolant to the interstage coolers will be supplied by a new 'A' coolant circulating system. Coolant flow in both the 'A' and 'B' systems will be "reversed" - i.e., pump to gas cooler to coolant cooler flow sequence.

6. Cells 2 and 3 are not required for operation; these cells will be pressured to 14.7 psia and the block valves buffered to prevent inleakage of moist air or uranium hexafluoride.

7. Tops (purge gas) from cell 6 or 4 will pass through a tops booster station; the 'A' boosters (K-311-1 to K-402-1) will be modified to operate as 9,000 rpm top boosters, individually or in series. Aftercoolers will be installed on these pumps, with coolant being supplied from the feed booster circulating system.

8. Flow from the top boosters will be carried to a new alumina trap station, and then to a new exhausting station, consisting of two 100 cfm Kinney pumps, one #2½ and one #3 air ejector, all in parallel.

9. The existing K-402-1 to K-311-1 interplant lines will be cut at K-311-1 and tied into the K-25 lower surge system. Tie-ins(2) will also be made in K-27 to permit utilization of these lines for surge volume and evacuation.

10. In order to control and measure the "lights" gradient in K-311-1, two AGA's, a space recorder and the existing line recorder will be utilized.(1) One AGA, 90-100% "lights" range will be used to control the break point between the high and low speed cells; the second AGA, range 0-100% "lights" will serve as a spare and for scanning; the space recorder will be utilized for measurement of UF_6 in the exit purge gas.

As per verbal agreement between H. M. Preuss of Area 2 and A. J. Mallett of Radiation Hazards, complete references to engineering drawings associated with the K-311-1 Purge Facility are not included in this letter, since design will necessarily extend beyond issuance of this letter.

(2) "Lower Purge Facility, Project 1586, W.O. 590569, Addendum #1", 10-1-53, letter by C. W. Calvin.

Operating Conditions

Equipment and operation of the K-311-1 purge facility is fundamentally the same as for normal cascade separating units. A summary of operating conditions is presented in "Stage Properties for K-311-1 Purge Cascade", KP-516.

Particular items requiring Special Hazards consideration include:

1. Alumina trap station.
2. Atmospheric exhaust station.
3. Coolant-in temperatures.
4. Required valve buffering.
5. Heating of K-310-1 to K-311-1 feed and return housing.
6. Omission of heat to tops booster.

1. Alumina Traps

Six parallel banks of three traps each in parallel with a bypass will be required. They will be manifolded so that any one or all banks may be used to accommodate the purge flow. The in-line spacing is to be a minimum of $3\frac{1}{2}$ ft. center to center and the row spacing is to be a minimum of 10ft. center to center. A barricade is to be erected between each trap to maintain this spacing and only one trap is to be moved at a time. Each trap is to be five in. I.D. schedule 40 pipe with a bed depth of six feet. The inlet and outlet piping will be one inch flanged and one thermocouple connection will be provided at the center of each trap bed. The traps will be removed by disconnecting the flanges and the thermocouple and emptying into an 'always-safe' container 5 in. diameter by 24 in. high or the alumina may be removed with an 'always-safe' vacuum cleaner and then emptied into the 'always-safe' container. They will be refilled with new activated alumina from 5 gallon buckets. Other details are similar to those for the 5 in. alumina traps, as shown on G & V drawing X-330-1214M.

2. Atmospheric Exhaust Station

Two Kinney pumps are to be connected in parallel with two air ejectors, the pumps to be equipped with 'always-safe' separators and oil overflow as detailed on C&CCC drawing C-AWP-15316-1.

3. Coolant-In Temperatures

The coolant inlet temperatures will be maintained at a set point based on the Benedict formula. Attached is Table I listing the operating pressures and the proposed minimum coolant inlet temperature.

4. Valve Buffering

All border valves will be closed, tested, buffered in the acceptable manner, and stop tagged. This will include the block valves and the cell evacuation valve on the two cells not to be used, i.e., cells 2

and 3; also, the K-311-1 valves originally known as the 'A' and 'B' building inverse valves; the 'A' normal outlet, 'B' normal inlet and 'B' spare inlet building block valves; the 'B' normal and 'A' spare building by-pass valves.

To prevent assay mixing due to the three possible feed and return points for K-311-1, these safeguards will be provided.

Operation of feed and return valves will be manual. These six valves will be equipped with microswitches, and integrated indication given on the graphic control panel to be installed in K-311-1. In addition, it is planned to maintain running buffers on the two feed and return points not in use, so that inadvertant crossties will be immediately recognized through inleakage detection.

Permanent buffers will also be applied to valves 27, 28, 30 and 31 to isolate K-25 from the 3 in. waste and PDF lines.

5. Heating of K-310-1 to K-311-1 Feed and Return Housing

The new 12" and 8" supply and return header from K-310-1 to K-311-1 will be enclosed in an insulated housing. By removing the insulation and cutting holes in the sheeting between the new housing and an existing housing, it is planned to heat the new housing with existing steam heaters. The following heat balance(3) indicates the capacity of the existing heaters are sufficient to carry the additional head load.

Existing available heat input - 107,500 B.T.U./Hr.
Total heat loss from existing and new housings at 140°F. and 60°F. ambient temperature - 83,900 B.T.U./Hr.

To prevent entry of any steam leakage to the existing K-25 pipe housing, bulkheads will be installed at all housing junctions.

6. Insulation of Tops Booster

No housing will be provided around the top booster compressors and associated piping. If two compressors are operating in series at the maximum allowable UF_6 concentration, as limited by compressor failure, the maximum UF_6 partial pressure obtainable would be 0.8 psia. No condensation could occur unless the ambient temperature dropped low enough to bring the pipe temperature to 52°F. In view of the large temperature rise across such high speed pumps and the extreme conditions permitting such relatively high UF_6 partial pressures, UF_6 condensation appears to be a remote contingency, and housing and associated expenditures are not justifiable.

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By authority of: CG-PGD-4
(classification guide)
Thomas W. Kelley 7/20/94
ADC for ADD signature (first reviewer) Date
Gary W. Wall 8/11/94
ADD signature (final reviewer) Date

H. M. Preuss

/ek

(3) Heating of Process Pipe, K-311-1 Purge Cascade, 10-16-53, letter from J. R. Render to A. J. Mallett.

TABLE I

Cell	Stage	Stage HSP (psia)	1.8 HSP (psia)	Benedict's Formula Min. Cool. Inlet (°F.)	Proposed Temps. (°F.)
K-311-1 - 4.6	1	2.00	3.60	96	110
5	2	2.00	3.60	96	110
4	3	2.00	3.60	96	110
3	4	2.00	3.60	96	110
2	5	2.00	3.60	96	110
1	6	2.00	3.60	96	110
K-311-1 - 6.6	7	2.00	3.60	96	110
5	8	2.00	3.60	96	110
4	9	2.00	3.60	96	110
3	10	2.00	3.60	96	110
2	11	1.95	3.51	95	110
1	12	2.00	3.60	96	110
K-311-1 -10.6	13	1.90	3.42	95	110
5	14	2.05	3.69	97	110
4	15	2.20	3.96	99	110
3	16	2.50	4.50	103	110
2	17	2.90	5.22	107	110
1	18	3.65	6.57	113	110
K-311-1 - 9.6	19	4.70	8.46	121	145
5	20	5.90	10.60	128	145
4	21	6.85	12.32	133	145
3	22	8.00	14.40	139	145
2	23	9.00	16.20	142	145
1	24	7.08	12.72	135	145
K-311-1 - 5.6	25	6.94	12.50	135	145
5	26	6.94	12.50	135	145
4	27	6.95	12.50	135	145
3	28	6.94	12.50	135	145
2	29	6.94	12.50	135	145
1	30	6.94	12.50	135	145

K-311-1.7 is spare for 5 or 9.

K-311-1.8 is spare for 4 or 6.